DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kobayashi et al (US Patent No. 6,077,403) in view of Pinarbasi (US Patent No. 5,492,605).

With respect to claim 1, Kobayashi et al discloses a sputtering device allowing a film to be formed (abstract).Fig. 1 depicts a sputtering discharge gas [41], a valve [43], and a flux adjuster [44] to regulate the flow of the gas into a sputtering chamber [1]. Fig. 1 further depicts a distance between a target [2] and a substrate [50]. Kobayashi et al further discusses the distance between the target [2] and substrate [5] is about 120 mm, with the mean free path about 5mm or less (i.e. smaller) (col. 3, lines 55-60). However Kobayashi et al is limited in that the mean free path being larger than the distance between the target and substrate is not suggested.

Pinarbasi teaches "an ion beam sputter deposition system and method for the fabrication of multilayered thin film structures" (abstract), and that using a magnetron sputter-deposition device for fabrication of thin film devices is well known in the art (col. 1, lines 17-19). Pinarbasi further discloses that during operation, a "vacuum chamber is maintained at an internal operation pressure on the order of $1x10^{-4}$ Torr by a vacuum

pump" (col. 5, lines 1-3). Pinarbasi depicts fig. 2 having a target [23] and substrate [31], with a distance between the target and the substrate. Pinarbasi states that "the mean free path for both sputtered target ions and the backscattered neutral atoms generally is greater than the distance between the target and the substrate" (col. 5, lines 56-58). Pinarbasi cites the advantage of the greater mean free path as optimizing selected properties of each layer for single-layered or multilayered structures (abstract).

It would have been obvious to one of ordinary skill in the art to include a mean free path larger than the distance between substrate and target as taught in Pinarbasi for the device of Kobayashi et al to gain the advantage of optimized layers for single-layered and multilayered structures.

With respect to claim 10, modified Kobayashi et al further discloses a substrate-biasing high frequency power source [81] that applies a high frequency voltage to the substrate [50] (col. 4, lines 19-21). In addition, modified Kobayashi et al discusses the distance between the target [2] and substrate [50] being 120 mm (col. 3, lines 55-56).

3. Claims 3, 8, 12, 15, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Donohue et al (USPGPub 2003/0024808) in view of Telford (US Patent No. 5,643,633).

With respect to claim 3, Donohue et al'808 discloses a method of sputtering a layer from a target using Krypton as the sputtering gas at a pressure of less than 1 millitorr (abstract). Donohue et al further discloses that the distance from the target to the wafer (i.e. substrate) is 430 mm (i.e. 43 cm) (p.1, para 14). Donohue et al further states that the pressure is kept at 0.85 millitorr (i.e. approximately 0.1133 Pa) for the sputtering apparatus. Maintaining the pressure at 0.85 millitor and the distance from

target to wafer at 430 mm would result in a pressure and distance product of approximately 4.87 cmPa, thus larger than 2.0 cmPa. Donohue et al further discloses “switching to Krypton enables lower pressure operation ~0.15 millitor” (i.e. 0.02 Pa) (p.1, para 17) of the sputtering apparatus while still keeping the distance between target and wafer at 430 mm. The product of this pressure and said distance is approximately 0.86 cmPa, thus smaller than 2.0 cmPa. However Donohue et al is limited in that while at least one layer is deposited, it does not specify if two or more layers are deposited.

Telford et al teaches a technique for a film deposited by chemical vapor deposition (abstract) by a method such as sputtering (col. 1, lines 45-47). Telford et al further teaches using a two-stage process, the first stage comprising a high pressure first stage, followed by a low pressure second stage (col. 7, lines 55-60). Telford et al lists the advantage of this two-stage pressure differential as overcoming a tendency of contamination that would exist between the two stages (col. 7, lines 60-63).

It would have been obvious to one of ordinary skill in the art to separate the vacuum chamber into two deposition parts of distinct pressures taught in Telford et al in the sputtering apparatus of Donohue et al to gain the advantage of decreasing the contamination that exists between the two deposition stages.

With respect to claim 8, modified Donohue et al further depicts fig. 1 having a moving magnetron [1] and a magnet on either side of the magnetron (p. 1, para 13). As the magnet moves the magnetic field intensity is altered, thereby creating an unbalanced magnetron.

With respect to claim 12, modified Donohue et al further discloses that the substrate may be negatively biased for operation at low pressures (p. 1, para 6) using a

power supply (p. 1, para 13). Donohue et al also states that the distance between the target to wafer (i.e. substrate) is 430 mm (i.e. 43 cm) (p. 1, para 14). Modified Donohue et al further states that using Krypton gas enables lower pressure operation of the apparatus (p 1, para 18).

With respect to claim 15, modified Donohue et al further discloses a plasma in proximity of the target (fig. 1, [2], [10]) confined by a magnetic field with a wafer (i.e. substrate) being biased by a power supply (p. 1, para 13). The voltage being applied to the target and plasma source is 135 volts (p. 1, para 14).

With respect to claim 17, modified Donohue et al further discloses the plasma source is a magnetron (p. 1, para 13; fig. 1, [1], [10]). The bias voltage being applied is 135 volts (p. 1, para 14).

4. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kobayashi et al (US Patent No. 6,077,403) and Pinarbasi (US Patent No. 5,492,605) as applied to claim 1 above, and further in view of Gupta et al (*Vacuum Technology & Coating*).

With respect to claim 6, the references are cited as discussed for claim 1. However Kobayashi et al is limited in that while magnetron sputtering is disclosed and depicted, it is not specified whether the magnetron operates in an unbalanced mode.

Gupta teaches a method of sputtering a layer from a target utilizing sputtering gas (p. 4, para 2). Gupta further teaches using a moving magnetron (i.e. linear scanning) (p. 1, para 1). As the magnet moves the magnetic field intensity is altered, thereby creating an unbalanced magnetron. Gupta lists the advantages of using a

Linearly Moving Magnetron (LMM) as exceptionally high uniformities and repeatabilities (p. 1, para 2 and 4; p. 3, para 3; p. 4, para 5; p. 5, para 1).

It would have been obvious to one of ordinary skill in the art to use the moving magnetron taught in Gupta as the magnetron in Kobayashi et al in order to gain the advantages of exceptionally high uniformities and repeatabilities.

5. Claims 14 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kobayashi et al (US Patent No. 6,077,403) and Pinarbasi (US Patent No. 5,492,605) as applied to claim 1 above, and further in view of Donohue et al (USPGPub 2003/0024808).

With respect to claims 14 and 16, the references are cited as discussed for claim 1. Modified Kobayashi et al further depicts in fig. 1 a plasma [P] in proximity of the target [2] with a magnetic field from magnets [71] in proximity of the target and plasma since it is expected that the magnetic field lines will extend uniformly to the target and substrate since electrode [6] is composed of the same material as the target [2] (col. 7, lines 1-7), thus allowing magnetic field through. Modified Kobayashi et al also discusses biasing the substrate at -100 V (col. 4, lines 32-35), However Kobayashi et al is limited in that while a power is attached to the target in fig. 1, a specific voltage is not suggested.

Donohue et al teaches a sputtering RF/DC magnetron (p. 1, para 14) with a plasma in proximity of the target (fig. 1, [2], [10]) confined by a magnetic field with a wafer (i.e. substrate) being biased by a power supply (p. 1, para 13). Donohue et al further teaches the plasma source is a magnetron (p. 1, para 13; fig. 1, [1], [10]). The voltage being applied to the target and plasma source (i.e. surface to be etched bias voltage) is 135 volts (p. 1, para 14).

It would have been obvious to one of ordinary skill in the art to use the voltage of Donohue et alas the voltage in the circuit for Kobayashi et al since Kobayashi et al fails to disclose a specific voltage and since Donohue et al teaches such voltages are functional in such devices, one would have a reasonable expectation of success in using the voltages of Donohue et al in Kobayashi et al.

Response to Arguments

<u>112 Rejection</u>

Applicant has amended claim 1 to no longer be indefinite. Therefore the rejection is withdrawn.

6. Applicant's arguments filed 4/28/2008 have been fully considered but they are not persuasive.

<u>103 Rejections</u>

7. On p. 4, the Applicant argues that one of ordinary skill would not be inclined to modify Kobayashi et al with Pinarbasi since a greater mean free path affects the properties of growing films by inducing damage and implantation.

The Examiner respectfully disagrees. Pinarbasi teaches that it is known to use a greater mean free path to affect the properties of growing films by inducing implantation, therefore one of ordinary skill in the art would be inclined to combine the teaching of Pinarbasi with Kobayashi et al to affect film properties in a desired method such as film

implantation, thus “optimizing selected properties of each layer for single-layered or multilayered structures (abstract)”.

8. On p. 4-5, the Applicant argues that neither Kobayashi et al nor Pinarbasi teach a two stage process of changing the mean free path between deposition stages.

The Examiner respectfully disagrees. Kobayashi et al teaches depositing a film using a mean free path smaller than the distance between a target and substrate (abstract; col. 3, lines 55-61). Pinarbasi teaches depositing a multilayer (i.e. two-stage deposition) film and having a mean free path greater than the distance between the target and substrate for affecting the properties of the deposited film, for example film implantation (abstract; col. 5, lines 54-63). Thus one of ordinary skill would have found it obvious to deposit a film by depositing a layer using a mean free path smaller than the distance between the target and substrate and then deposit another layer using a mean free path greater than the distance between the target and substrate to desirably affect the film properties in order to "optimiz[e] selected properties of each layer for single-layered or multilayered structures (abstract)”.

9. On p. 5, the Applicant argues that combining Donohue et al with Telford et al would not be obvious since Telford et al teaches a chemical vapor deposition (CVD) technique in addition to teaching away from using a physical vapor deposition (PVD) technique.

The Examiner respectfully disagrees. While Telford et al does teach using CVD technique, Telford et al also discloses that it is known in the prior art to have two deposition parts of distinct pressures in a (PVD) apparatus (col. 1, lines 45-49), with the advantage of using a two-stage process as limiting contamination between the different

stages. Therefore it would have been obvious to one of ordinary skill in the art to combine the teachings of Donohue et al and Telford et al.

Conclusion

10. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Band whose telephone number is (571) 272-9815. The examiner can normally be reached on Mon-Fri, 8am-4pm, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on (571) 272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

12. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR.

Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/M. B./

Examiner, Art Unit 1795

/Alexa D. Neckel/

Supervisory Patent Examiner, Art Unit 1795